

CLAIMS

1. A display substrate, comprising:
a plate;
5 at least one display component formed on the plate; and
an acoustic transducer formed on the plate over a cavity.
2. A display substrate according to claim 1, wherein the acoustic
transducer is a microphone or a speaker, and comprises a fixed electrode and
10 a diaphragm comprising a vibrating electrode.
3. A display substrate according to claim 2, wherein the vibrating
electrode is formed from a same layer of conductor as at least a first part of the
one or more display components.
- 15 4. A display substrate according to claim 2, wherein the fixed
electrode is formed from a same layer of conductor as at least a second part of
the one or more display components.
- 20 5. A display substrate according to claim 2, wherein the diaphragm
further comprises an insulation layer.
6. A display substrate according to claim 5, wherein the insulation
layer of the diaphragm is formed from a same insulation layer as at least a part
25 of the at least one display component.
7. A display substrate according to claim 1, wherein the cavity is
between the acoustic transducer and a surface of the plate.
- 30 8. A display substrate according to claim 1, wherein the cavity is
formed in the plate.

10099758-031503

9. A display substrate according to claim 8, wherein the cavity extends the whole depth of the plate.

10. A display substrate according to claim 8, wherein the cavity is a powderblasted cavity.

11. A display substrate according to claim 1, wherein the at least one display component forms an active matrix array such that the display substrate is an active matrix substrate for a liquid crystal display device.

12. A display substrate according to claim 11 wherein the active matrix array comprises thin-film-transistors and the vibrating electrode is formed from a same layer of conductor as the gates of the thin-film-transistors.

13. A display substrate according to claim 11, wherein the active matrix array comprises pixel electrodes and the fixed electrode is formed from a same layer of conductor as the pixel electrodes.

14. A display substrate according to claim 1, wherein the at least one display component is a common electrode such that the display substrate is a passive substrate for a liquid crystal display device.

15. A method of forming a display substrate, comprising:
providing a plate;
forming at least one display component on the plate; and
forming an acoustic transducer on the plate over a cavity.

16. A method according to claim 15, wherein the step of forming an acoustic transducer comprises forming a microphone or a speaker comprising a fixed electrode and a moveable diaphragm, the moveable diaphragm comprising a diaphragm electrode.

17. A method according to claim 16, wherein the diaphragm electrode is formed from a same layer of conductor as at least a first part of the at least one display component.

5 18. A method according to claim 16, wherein the fixed electrode is formed from a same layer of conductor as at least a second part of the at least one display component.

10 19. A method according to claim 16, wherein the moveable diaphragm further comprises an insulation layer.

15 20. A method according to claim 19, wherein the insulation layer of the diaphragm is formed from a same insulation layer as at least a part of the at least one display component.

21. A method according to claim 15, wherein the step of forming an acoustic transducer comprises forming a piezoelectric buzzer.

20 22. A method according to claim 15, wherein the cavity is formed between the acoustic transducer and a surface of the plate.

23. A method according to claim 15, wherein the cavity is formed in the plate.

25 24. A method according to claim 23, wherein the cavity is formed such as to extend the whole depth of the plate.

25. A method according to claim 23, wherein the cavity is formed by powderblasting.

30 26. A method according to claim 15, wherein the step of forming at least one display component on the plate comprises forming an active matrix

20251001 09:56:00

array such that the display substrate is an active matrix substrate for a liquid crystal display device.

27. A method according to claim 26, wherein the active matrix array
5 comprises thin-film-transistors and the diaphragm electrode is formed from a same layer of conductor as the gates of the thin-film-transistors.

28. A method according to claim 26, wherein the active matrix array
10 comprises pixel electrodes and the fixed electrode is formed from a same layer of conductor as the pixel electrodes.

29. A method according to claim 15, wherein the step of forming at
15 least one display component on the plate comprises forming a common electrode such that the display substrate is a passive substrate for a liquid crystal display device.

30. An acoustic transducer, comprising:
a plate of an insulating material;
a cavity in the plate;
20 a plurality of layers that have been deposited on the plate; and
a moveable member formed from the deposited layers and positioned over the cavity.

31. An acoustic transducer according to claim 30, wherein the
25 acoustic transducer further comprises a fixed electrode opposing the moveable member; the moveable member comprises a moveable electrode formed from a first metal layer the first metal layer being one of the plurality of layers, and an insulating layer the insulating layer being another one of the plurality of layers; and the fixed electrode is formed from a second metal layer the second
30 metal layer being another one of the plurality of layers.

32. A method of forming an acoustic transducer, comprising:

2054633-0000

providing a plate of an insulating material;
depositing a plurality of layers on the plate;
forming a cavity in the plate; and
forming, from the deposited layers, a moveable member
positioned over the cavity.

5

33. A method according to claim 32, further comprising forming a
fixed electrode opposing the moveable member; and wherein the moveable
member is formed from a moveable electrode formed from a first metal layer
the first metal layer being one of the plurality of layers, and an insulating layer
the insulating layer being another one of the plurality of layers; and the fixed
electrode is formed from a second metal layer the second metal layer being
another one of the plurality of layers.

10

34. A method according to claim 32, wherein the cavity is formed by
powderblasting.

15

2057ED 03/26/00T